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Notes on breeding of Salvadori's Teal *Anas waiguiensis* and other birds in Crater Mountain Wildlife Management Area, Papua New Guinea

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The breeding biology of many New Guinea bird species is little known (Beehler *et al.* 1986, Coates 1985, 1990, Mack 1994). For many principally Australian species information on breeding has been inferred from studies and records there (Mack 1994). Coates (1985) noted that the breeding seasons of New Guinea birds can be generally classed as: a) hawks—dry season; b) granivorous grassland and savanna species—wet season; c) insectivores and mixed feeders—late-dry to early-wet season; d) frugivores—all year; and e) waterbirds—late-wet to mid-dry season. However, such generalisations may not be applicable to regions experiencing no distinct seasonal variation in rainfall, such as occurs in the area of this study.

Breeding of birds was recorded in the Crater Mountain Wildlife Management Area (CMWMA), in the Eastern Highlands of Papua New Guinea, during a study of the importance of home-gardens (hereafter gardens; any cleared or historically altered land, principally for agricultural purposes) for insectivorous and nectivorous species. This paper serves to augment information on the breeding biology of some Papua New Guinea birds; in particular that of Salvadori's Teal *Anas waigniensis*. Breeding records, in this area with seasonally unpredictable rainfall, may be of significance to a future understanding of avian breeding biologies in the tropics.

Methods and study area

The study was conducted in CMWMA, a 27,000-ha region on the borders of Chimbu, Eastern Highlands and Gulf provinces, in the Purari River catchment. The region encompasses some of the largest sections of primary forest in Papua New Guinea, and ranges from lowland tropical forest on the Purari River (50 m) to montane forest and subalpine scrub on the summit of Crater Mountain, at 3,100 m (Mack & Wright 1996, Wright *et al.* 1997, Igag & Murphy 2002). Over a 3.5-year period, rainfall at Crater Mountain Biological Research Station (CMBRS: Fig. 1; *c.*900 m, 06°43'S, 145°05'E) averaged 6,400 mm/p.a., ranged from 180–960 mm/month and was seasonally unpredictable (Wright *et al.* 1997). Igag (2002), however, referred to the austral late autumn/early winter (March–June) as the 'dry period', when less rainfall occurred, although monthly variation did not appear significant. Humidity is high and treefalls as a result of strong winds common (Wright *et al.* 1997; CTS pers. obs.).

Evidence of birds breeding was collected from mid April to mid October 2002, at altitudes of 300–900 m (Fig. 1, Table 1). All observations were opportunistic and made north of the Pio River. Information collected on each nest was circumstantial and depended on available time. Habitats surveyed ranged from small active gardens (crops of sweet potato, sago palm, banana and vegetables), abandoned gardens of different ages, little-disturbed primary forest (subject only to periodic hunting and small-tree removal), and pristine lowland to hill forest (Paijmans 1976). Details of Palm Cockatoo *Probosciger arterrimus*, Eclectus Parrot *Eclectus roratus* and Pesquet's Parrot *Psittrichas fulgidus* are not included here, as they have been presented earlier (Igag 2002), and information on Sulphur-crested Cockatoo *Cacatua galerita* nests is also not given here (except in two examples, see Rainbow Lorikeet *Trichoglossus haematodus* and Grey Crow *Corvus tristis* accounts) as cavities were high in canopy trees and were not inspected.

Feeding and functional guilds are indicated thus: a) Haw = hawks, b) Gra = granivores, c) Ins = insectivores and mixed feeders, d) Nec = nectarivores [not considered by Coates (1985)], e) Fru = frugivores, and e) Wat = waterbirds (Coates 1985, Beehler *et al.* 1986). Specific nest dimensions are indicated by OD (outside diameter of nest bowl) and ID (inside diameter of nest bowl). Nest depth refers to the bowl and nest length refers to total vertical dimension. The approximate altitude at which each nest was recorded is also presented. Nomenclature follows Beehler *et al.* (1986).

Nests for which specific information was provided by landowners is referenced (LO pers. comm.) and those where information was proffered by Trained Local Observers as (TLO pers. comm.). TLOs are local landowners, knowledgeable in local fauna and flora, trained to assist visiting researchers and dedicated to promoting sustainable use of the environment through research and eco-tourism. Most nests were positively identified by CTS, by observing the nest or adults of the respective species in nest attendance, and are indicated (CTS pers. obs.).

TABLE 1

Study areas within CMWMA in which nests and breeding were observed. Nests recorded in Results are noted as being observed in the vicinity of one of these settlements or the research station (CMBRS) (see Fig. 1).

Settlement	Habitat type	Altitude (m)	Grid reference
Haia	Hill/lowland forest transition, village established 1970s around airstrip, high levels of disturbance and active gardens closer to village	650–830	06º42'S, 144º59'E
Yabaramaru	Lowland forest, village established after Soliabedo abandoned (National Mapping Bureau 1985)	300–450	06º43'S, 144º50'E
Yualaido	As previous site	300–400	06º43'S, 144º52'E
Wara Oo	Hill and lowland forest, small village of *c.*100 people, lower levels of disturbance with increased distance from settlement	450–650	06º45'S, 145º02'E
CMBRS	Hill forest, research station established late 1980s, moratorium on hunting and gathering in area	850–950	06º43'S, 145º 05'E

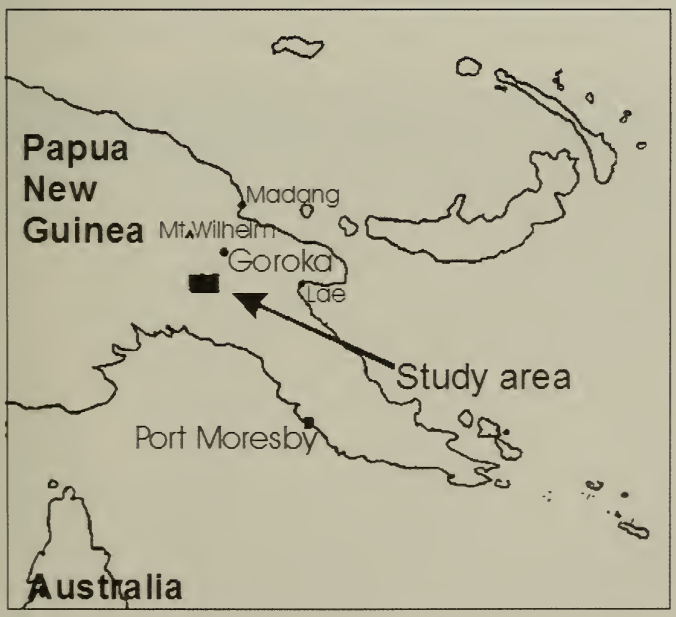

Figure 1. Map showing general area of the Crater Mountain Wildlife Management Area where the study occurred.

TABLE 2

Egg-laying months (extrapolated for those nests without eggs) of birds in CMWMA. Guilds include: a) granivores, b) insectivores and mixed feeders, c) frugivores, and d) waterbirds (Coates 1985). Only months in which the study was conducted are shown. Number of records is given together with the number of species in parentheses. Months in which least rainfall was recorded at Haia (1998–2001) are shaded (March–June) (Igag 2002).

Guild	Apr	May	Jun	Jul	Aug	Sep	Oct	TOTALS
Granivore					1			1 (1)
Insectivore and mixed			1	8	6	9	2	26 (15)
Frugivore	4	2	2	3			1	12 (8)
Water				1	1	2		4 (2)
Totals	4	2	3	12	8	11	3	43 (26)

Results

Nests recorded in this study are summarised below. Those species recorded nesting by Mack (1994) are indicated *. Thirty-two species in 17 families were recorded breeding in CMWMA. Egg-laying month was estimated for each observation of an active nest. These are summarised in Table 2 for all breeding records and are also presented in parentheses at the start of each breeding observation account. Species allocated to more than one guild were considered mixed feeders. Not all breeding records are presented below, as some do not amplify existing data (five species in four families) (Coates 1985, 1990, Mack 1994).

Mean clutch size for open nesting birds was 1.5 (n=26) (an open nest being defined as one in which the nest bowl is exposed to the environment from above). The mean number of nestlings recorded per nest (1.2; n=9) was lower (due to predation, egg infertility, nestling death, other loss) than the mean number of eggs per nest (1.6; n=17) (waterbirds excluded from means).

Nest records

SALVADORI'S TEAL *Anas waiguiensis* (Wat)

Haia (440 m): a large tree growing at *c*.45° over the Mei River (between the Je and Nimi rivers; 06°43'S, 144°57'E) contained an old nest (TLO pers. comm.). The site, *c*.6 m above the river, was set in vegetation and epiphytes on the upper side of the main trunk. One egg was removed two years previously (LO pers. comm.).

Yabaramaru (305 m): an island on the Wi River harboured several old nests (LO pers. comm.). On 28 July, four separate shallow depressions within a 10-m radius, scraped in the soil and concealed by grass, were identified as having previously been used (LO pers. comm.). A local landowner indicated that one nest had contained three eggs and another had produced four chicks in *c*.1997 (LO pers. comm.). Another possible nest further upstream was not visited (LO pers. comm.).

Haia (August, 630 m): on 24 August an incubating bird was flushed from a nest on a large boulder island in the middle of the Nimi River (Fig 2, CTS pers. obs.).

Figure 2. Large boulder island in the Nimi River where a Salvadori's Teal *Anas waiguiensis* nest was identified. An incubating bird was flushed off the nest site at the apex of the rock. The river level was relatively low, flowing only one side of the rock during nest inspection (Craig T. Symes)

Figure 3. Salvadori's Teal *Anas waiguiensis* nest on large boulder island in Nimi River, showing exposed eggs after the incubating bird was flushed off the nest (Craig T. Symes)

Figure 4. 'Log island' in the Nimi River with TLO, Ijenepe Houmore, indicating site of the Salvadori's Teal *Anas waiguiensis* nest (Craig T. Symes)

Figure 5. Salvadori's Teal *Anas waiguiensis* nest on 'log island' on the Nimi River, showing down covering eggs. The adults were absent (Craig T. Symes)

The river was low and only flowing west of the island at the time. During higher rains the rock is surrounded by water (TLO pers. comm.). The rock was *c.*4 m high on the accessible side (rock diameter *c.*6–10 m) with grass and small shrubs covering the top 2 m of exposed rock. Three cream-white eggs were partially hidden by off-white down in a grass nest (OD *c.*20 cm, ID *c.*9 cm). On 21 August three eggs were in the nest (LO pers. comm.) (Fig. 3).

Haia (September, 770 m): on 20 August (hereafter Day 1) a possible nest on a small 'log island' in the Nimi River north of Haia was discovered (TLO pers. comm.), it being a scrape in the soil, concealed by grass growing on the log (CTS pers. obs.). Water level was low and the river only flowed east of the 'island'. The log, which had become attached to rocks in the river, was *c.*10 m downstream from a crossing point in the river (the path from Haia to Karamui) (Fig. 4). Visits to the nest site attempted to minimise disturbance and only involved peering at the nest when the adults were absent, and then departing. The following is a record of visits to the site (CTS pers. obs., TLO pers. comm.). *Day 7*: on approaching the nest one bird flew from nearby and settled *c.*20 m upstream on exposed rocks in the river. It remained until CTS and a TLO departed *c.*10 minutes later. The scraping appeared deeper, being a shallow depression in the damp soil. *Day 10*: the scrape was finely lined with dry grasses. *Day 12*: the nest was lined with more dry grasses and two small green fern fronds. Another scraping was observed in the ground *c.*50 cm away, possibly from where nest material had been collected. *Day 13*: a single cream-white egg was present in the nest, which was still lined with grass. No birds were seen. *Day 14*: the nest was as the day before, but the egg was finely smeared with dirt and mud. *Day 16*: as previous inspection; no birds were observed. *Days 18 & 20*: two eggs were present. *Days 22 & 24*: three eggs were present; the nest was still lined only with grass. *Days 26 & 29*: a bird was at the nest and was not disturbed. *Day 32*: an incubating bird was flushed and flew upstream out of sight. The nest had four eggs and was lined with a thick layer of down. *Day 38*: no bird was observed at the nest but one was seen flying upstream. It briefly settled on a submerged rock before moving into some rapids. The nest had four eggs, nestled beneath a layer of down feathers. *Days 42 & 44*: the four eggs were covered with feathers and an adult was foraging downstream (Fig. 5). *Days 48, 50, 52 & 54*: the nest appeared abandoned probably due to human passage along the nearby footpath or observer disturbance.

Haia (September, 740 m): on 10 September four eggs were in a nest on a large rock beside the Ware River (a tributary of the Ooh east of Haia) (TLO pers. comm.). The nest was set in a hollow in grass on the riverbank and lined with feathers (M. Opiang pers. comm.). On 21 September the nest was empty, the eggs possibly removed by humans.

A report from a landowner who removed 15 eggs from a nest on an island on the Nimi River is considered suspect given the numbers of eggs observed in nests in this study (TLO pers. comm.). Salvadori's Teal was also indicated to occur regularly on a stretch of river (width 30–50 m) near the Torrent Flycatcher nest on

the Je (TLO pers. comm.). A landowner assured CTS that birds roosted on a large boulder (height 2 m above water, diameter *c.*8 m) in the middle of the fast-flowing river *c.*1 km downstream of the flycatcher nest. A teal feather was found on a rock but no birds were seen during observations one evening. The species was also reported to occasionally occur on the Pio River (TLO pers. comm.) (river width 50–100 m), a more turbid river (CTS pers. obs.).

GREY-HEADED GOSHAWK *Accipiter poliocephalus* (Haw)
Haia (840 m): on 25 August an adult was flushed from a nest in a subcanopy tree (nest height 6.5 m; tree height *c.*14 m) (TLO pers. comm.). The tree was at the edge of an active garden north of Haia. The nest, a deep bowl of twigs and small branches, was lined with leaves and set against the main trunk. On 1 and 4 September the nest was still empty (CTS pers. obs.).

BROWN CUCKOO-DOVE *Macropygia amboinensis* * (Fru/Gra)
Haia (May, 875 m): on 27 May an adult was flushed from a nest, *c.*6 m above ground, in the fronds of a *Pandanus* sp. (tree height *c.*8 m; dbh 17.5 cm above support roots). The forest canopy was open. On 7 June a male was sitting on the same nest.

GREAT CUCKOO-DOVE *Reinwardtoena reinwardtii* * (Fru/Gra)
Wara Oo (April, 550 m): on 12 May a nest on a ledge (height 2.4 m, dimensions 20 x 80 cm) *c.*1.5 m from a small waterfall contained one chick covered in pinkish-white down. The nest was a shallow bowl sparsely lined with fine plant material. An adult flew off on approaching the nest (CTS pers. obs.). A week earlier a single egg was in the nest (TLO pers. comm.).

Yabaramaru (July, 480 m): on 22 July a bird incubating a single white egg was flushed from a nest on a cliff ledge *c.*12m above ground (CTS pers. obs.). The *c.*25 m-high cliffs formed the entrance to a large sinkhole, in a valley, in pristine forest.

Yabaramaru (June, *c.* 450 m): on 24 July young boys brought CTS a nestling they had collected from a cliff nest in nearby forest. The nestling was adult size, with blue-black feathers and a half-grown tail; the legs and bill were black.

WOMPOO FRUIT-DOVE *Ptilinopus magnificus* (Fru)
Yabaramaru (July, 440 m): on 29 July a bird was incubating a single white egg in a nest *c.*6 m above ground in a forest understorey tree (dbh 22 cm). The nest was flat, with a base of small sticks and twigs, lined on the upper surface with smaller twigs and vine tendrils, sited in little-disturbed lowland forest. On 3 August the nest appeared destroyed, possibly by debris falling from the canopy (CTS pers. obs.).

SUPERB FRUIT-DOVE *Ptilinopus superbus* * (Fru)
Wara Oo (May, 750 m): on 14 May a single white egg was in a nest on a branch (diameter 4.5 cm) of a small understorey tree (dbh 20 cm) (CTS pers. obs.). The

nest was a sparse platform of rigid twigs, with no evident bowl, at a height of 2.65 m. An adult flew off on approaching the nest (TLO pers. comm.).

Yualaido (July, 440 m): on 31 July a female was flushed from a nest at a height of 2.5 m. The nest was a thin layer of rigid twigs sited in the fork of a horizontal branch of an understorey tree of *c.*6 m (dbh 4 cm). A single white egg was visible from below (CTS pers. obs.).

BEAUTIFUL FRUIT-DOVE *Ptilinopus pulchellus* * (Fru)
Wara Oo (635 m): on 5 October a male was flushed from an empty nest in an understorey tree in little-disturbed forest. Next day the nest was still empty (CTS pers. obs.).

ZOE IMPERIAL PIGEON *Ducula zoeae* (Fru)
Haia (April, 760 m): on 23 April a bird was observed at a nest in a large tree within an abandoned coffee plantation. The nest was *c.*13 m above ground in the outermost branches (CTS pers. obs.).

RAINBOW LORIKEET *Trichoglossus haematodus* (Nec/Fru)
Haia (770 m): on 8 May a pair was seen entering a cavity between the branch of a large canopy tree and a mass of ferns and epiphytes growing on the branch. The cavity was *c.*20 m above ground. At the same time a pair of Sulphur-crested Cockatoos was active at another cavity (height *c.*25 m) in the same tree (CTS pers. obs.).

GLOSSY SWIFTLET *Collocalia esculenta* (Ins)
Yabaramaru (June, *c.*450 m): on 24 July young boys brought CTS three nests of the species. Each contained a single nestling at different stages of development. The nests had been removed from a low cliff in nearby pristine forest (see Great Cuckoo-dove). Each nest was a small delicate cup of plant material, neatly lined on the outside with fine live moss.

RUFOUS-BELLIED KOOKABURRA *Dacelo gaudichaud* (Ins)
Yabaramaru (490 m): a cavity (diameter *c.*7 cm, entrance height 3.2 m) within a spherical ant nest (diameter *c.*70 cm) was pointed out by a landowner as an old breeding site. The nest was in a *Pandanus* sp. (dbh 13 cm) in a recently abandoned garden. The cavity was in use by bees when inspected on 22 July.

DWARF KINGFISHER *Ceyx lepidus* (Ins)
CMWMA (400–800 m): excavated cavities (fresh and old) were frequently observed at the base of treefalls. The soil lifted by the roots of the fallen tree provided a near-vertical bank into which the excavations were made (CTS pers. obs.). These cavities were indicated as Dwarf Kingfishers nest sites by TLOs. Some were shallow cavities and, being next to paths, were likely abandoned, and in some

the end was not visible. None was thoroughly inspected. A Dwarf Kingfisher was observed in an abandoned garden, leaving a freshly worked cavity on the underside of a toppled tree.

BLYTH'S HORNBILL *Rhycticeros plicatus* (Fru)
Wara Oo (April, *c.*600 m): an unidentified tree species felled by a landowner in mid April contained four eggs (TLO pers. comm.). A sample of the nest plug brought to CTS had a distinctive aromatic citrus smell (CTS pers. obs.).

WHITE-BELLIED THICKET FANTAIL *Rhipidura leucothorax* (Ins)
Yualaido (July, 465 m): on 1–2 August two pale brown eggs, speckled darker brown at the broad end, were being incubated in a nest suspended from a dead vine on a sago palm *Metroxylon sagu* (CTS pers. obs.). The nest, lined on the outside (OD 7 cm) with dry bamboo and sugarcane leaves bound with spider web silk, was lined smoothly in a neat bowl (ID 6 cm) with spider silk. The nest was *c.*15 cm long with the base a tapering 'tail' of fine hanging material and spider silk. The nest was 2.5 m above a small stream (width 2 m), directly above a small log bridge.

CHESTNUT-BELLIED FANTAIL *Rhipidura hyperythra* * (Ins)
Haia (July?, 835 m): on 4 September a nest adjacent to a regularly used trail (*c.*3 m wide) in little-disturbed forest was indicated as belonging to the species (TLO pers. comm.). It appeared to have been used recently and was sited in the horizontal branch of an understorey tree at a height of 3.3 m. The nest was a neatly compacted mesh of fine plant material and spider webs. A 0.5–1.0-cm portion of the nest lip was raised in a small bump. Nest length was 8–10 cm with threads of material hanging below the nest.

NORTHERN FANTAIL *Rhipidura rufiventris* (Ins)
Haia (August, *c.*830 m): on 4 September a bird was incubating two eggs in a nest in a garden tree (nest height 3.1 m, tree height *c.*5 m). The eggs were white, lightly speckled rufous-red (LO pers. comm.). The nest was a neatly compacted bowl of woven plant material and spider webs sited in a horizontal fork (CTS pers. obs.).

HOODED MONARCH *Monarch manadensis* (Ins)
Yualaido (July, 450 m): two dark brown eggs, speckled darker at the broad end, were being incubated on 2 August. The nest, 1.65 m high in the fork of a small understorey tree (dbh 1.5 cm, height *c.*2.5.m), was a neat bowl (OD 10 cm, ID 4.5 cm) lined inside with fine epiphyte roots. Fresh moss on the outside hung below the nest in a 'tail' (nest length 22 cm). Two other nests, thought to be of monarchs (TLO pers. comm.), were found: on 4 September (empty but with fresh faeces) and 25 September (one egg).

TORRENT FLYCATCHER *Monachella muelleriana* (Wat)
Yualaido (July, 470 m): on 3 August a nest, a neat bowl of finely woven epiphyte roots, the exterior lined with moss (OD 9 cm, ID 6 cm, length 6 cm, depth *c.*2 cm), was observed on the ledge of a large boulder in the Je River. The nest was *c.*2.5 m above the water and 30 cm below the top of the boulder, on which grass was growing. A nestling in pin, and a pale brown egg with darker brown patches, were present in the nest (CTS pers. obs.).

BANDED YELLOW ROBIN *Poecilidryas placens* (Ins)
Haia (July, 760 m): on 22 August a fully feathered nestling was observed in a nest in pristine hill forest (CTS pers. obs.). The nest (length 2 cm, depth *c.*1 cm) was 1.7 m above ground in a low (3.3.m) understorey tree (dbh 3 cm), on the horizontal fork of a side branch, and was constructed of tendrils and fine epiphyte roots, lined on the outside with moss. On 26 August the nest was empty and the nestling had perhaps fledged (CTS pers. obs.).

Wara Oo (August, 580 m): on 30 September a small nestling was observed in a nest (height 2.1 m) in an understorey shrub (height 2.5 m) in pristine forest. The nest, set on a horizontal side branch, was a shallow bowl of finely woven epiphyte roots and plant material, with live moss on the outside (OD 9 cm, ID 5 cm).

GREY WHISTLER *Pachycephala simplex* (Ins)
Haia (August?, 830 m): a nest *c.*12 m above ground was observed under construction in a tree (height *c.*15 m) on the edge of an active garden. The nest was in the foliage of a horizontal side branch. On 30 August an adult was seen bringing a 3–4-cm dry leaf to the nest. On 3 September, in 14 minutes, an adult was seen bringing an epiphyte root (*c.*5 cm long), a dry leaf with only the veins remaining (*c.*6 cm) and a grasshopper to the nest (CTS pers. obs.).

LITTLE SHRIKE-THRUSH *Colluricincla megarhyncha* * (Ins)
Haia (September, 760 m): on 20 September a nest, the inside lined with fine epiphyte roots and plant material, and the outside with large dead leaves, was found beside a footpath within little-disturbed forest. The nest (OD 14 cm, ID 7 cm, length 14 cm) was set against the main stem of a small understorey tree (dbh 4 cm, height 2.1 m) at a height of 1.4 m, and contained two cream-brown eggs, speckled brown all over, with a darker band of almost complete brown at the broad end. On 26 September the two eggs were still present (CTS pers. obs.).

Wara Oo (September, *c.*570 m): a nest, 2.15 m above ground, was found on 30 September in a subcanopy tree (height *c.*23 m) in pristine forest. It was observed again on 1 October. A single cream egg, speckled dark brown all over, more lightly at the narrow end, was missing on 2 October. The nest (OD 12 cm, ID 6 cm, length 11 cm) was set in a leaf whorl near the main trunk (dbh 3 cm). The outside of the nest was a rough layer of leaves and twigs (CTS pers. obs.).

RUSTY PITOHUI *Pitohui ferrugineus* * (Ins/Fru)
Yualaido (July, 445 m): a single pale blue egg, lightly flecked brown, green and red at the broad end, was found on 18 July. The nest (OD *c.*13 cm, ID *c.*8cm, length *c.*11 cm) was in the fork of a climber on a small forest understorey tree (dbh 2.5 cm, height 4 m) at a height of 2.3 m. It was a neat bowl, the outside a mesh of vine and tendril twigs, the inside lined with fine bark and epiphyte roots. The habitat was little-disturbed lowland forest (e.g. small-tree removal) (CTS pers. obs.).

Haia (October, 780 m): on 14 September a bird was observed constructing a nest 3.15 m high in an understorey tree within a home-garden clearing. On 28 September the nest was still empty. On 22 October a small nestling, covered in brown feathers, was observed in the nest (length *c.*15 cm, OD *c.*12 cm). The outside of the nest was an untidy arrangement of twigs and sticks, and was set in a fork of the main trunk (dbh 4.5 cm) (CTS pers. obs.).

Observations at this nest suggested that the period between nest construction and egg laying is at least two weeks.

BLACK BERRYPECKER *Melanocharis nigra* * (Ins/Fru)
Wara Oo (September, 600 m): on 30 September an adult was observed incubating at a nest (height 2.25 m) in an understorey tree (height 2.5 m, dbh 2.0 cm) within pristine forest (CTS pers. obs.). The nest was a tightly woven cup (OD 5 cm, ID 4 cm, length 6 cm) of fine epiphyte roots with lichen on the outside, and was sited in the fork of a small horizontal branch. The two eggs were creamy-white blotched dark brown, heaviest at the broad end. The incubating bird and eggs were observed again on 1, 2 and 6 October.

BLACK SUNBIRD *Nectarinia aspasia* (Nec/Ins)
Haia (August, *c.*795 m): on 11 August a pair was observed nest building in the foliage of an understorey tree at a height of *c.*8 m. The site was in little-disturbed hill forest.

LONG-BILLED HONEYEATER *Melilestes megarhynchus* * (Ins)
Haia (July?, 835 m): on 19 September an adult was observed feeding a juvenile in the subcanopy of second-growth forest.

DWARF HONEYEATER *Oedistoma iliolophus* * (Ins/Nec)
Yualaido (July, 455 m): a nest indicated as of this species was observed on 18 July in a small tree in an active garden (LO pers. comm.). The nest was sited 1.45 m above ground in a 2.5 m-high tree (dbh 5.5 cm). Two white eggs were present in the deep bowl of bamboo leaves and grass, lined with finer plant material (OD 9 cm, ID 4 cm, length 11 cm) (CTS pers. obs.). The nest was probably abandoned due to the increased presence of gardeners in the vicinity.

Haia (August, *c.*810 m): a nest under construction was observed on 24 August in a small (1.2 m) understorey shrub in mildly disturbed hill forest. The nest was

0.75 m above ground and shielded by fern fronds *c.*10 cm above the nest. On 27 August the nest (OD 9 cm, ID 4.5 cm, length 8 cm) of fine woven plant material and epiphyte rootlets was unlined, but on 3 September it was lined with fine clear white seed material and contained one white egg, finely speckled pale rufous at the broad end. On 4 September an adult was observed incubating at the nest, the bird's bill only just visible. On 19 September the nest was empty.

Haia (October, 830 m): on 28 September a nest was observed under construction 1 m high in an understorey shrub in pristine forest (TLO pers. comm.).

SCRUB WHITE-EARED MELIPHAGA *Meliphaga albonotata* (Ins/Fru)

Yualaido (July, 445 m): on 18 July a nest with two cream eggs, lightly speckled dark brown, was found in a garden tree (*Ficus* sp., dbh 17 cm, height *c.*15 m) at a height of *c.*11 m (CTS pers. obs.). The nest was constructed of woven bamboo leaves and moss, well camouflaged in the tree canopy. On 29 July, two lightly feathered nestlings were present (TLO pers. comm.).

Haia (September, *c.*800 m): on 4 September a nest was observed under construction at a height of *c.*7 m in a 16-m subcanopy tree within an abandoned garden. The nest was a fine ball of intertwined moss, grass and white seed material, with some leaves, and was set in a horizontal fork, with most of the nest set below the branch. On 25 September the nest was complete.

Haia (September, 775 m): on 28 September a nest (OD *c.*8 cm, ID *c.*7 cm, depth *c.*8 cm) was found 2.3 m above ground in a shrub (dbh 5 cm) in regrowth within an abandoned garden (CTS pers. obs.). The thin-walled nest of fine grass and bamboo leaves, with moss embedded, was lined with fine white seed material. Like the previous nest, the top was level with the branches in a horizontal fork. Two nestlings, with grey-black skin and in pin, had bright yellow gapes and opened their eyes when alert.

Wara Oo (September, 610 m): on 29 September a single pinky-cream egg, speckled dark rufous at the broad end, was observed in a nest 2.3 m above ground (CTS pers. obs.). The nest (OD *c.*8 cm, ID *c.*7 cm) was woven onto the branches of a horizontal fork in a tree (dbh 5 cm, height *c.*3.5 cm), the top of the nest level with the branches. The nest was flimsy with moss on the outside and fine woven grass on the inside, lined with fluffy white seeds. The egg was still present on 2 October.

Haia (September, 730 m): on 29 September two nestlings were observed soliciting food in a nest (height 2.4 m) in the horizontal fork of a creeper within a large canopy tree. The top of the nest was set below the branch and was a thin-walled construction of moss and leaves. Habitat was near-pristine forest.

TAWNY-BREASTED HONEYEATER *Xanthotis flaviventer* (Fru/Ins)

Haia (*c.*790 m): on 1 September an adult departed after removing a tendril from the branch of a subcanopy tree in an abandoned garden (CTS pers. obs.).

STREAK-HEADED MANNIKIN *Lonchura tristissima* * (Gra)
Haia (August, 775 m): on 31 August a nest indicated as of this species was observed in an abandoned garden without trees (LO pers. comm.). The nest (OD 7 cm, ID 4 cm), an untidy woven ball of coarse grass and bamboo leaves, was 1.6 m above ground within the foliage of a shrub. It contained four eggs, three pale brown, speckled rufous, and the other white, flecked brown at the broad end. Such discrepancy in egg coloration is only readily explained if the nest had been parasitised by a cuckoo, although such behaviour is unmentioned in the secondary literature (Restall 1996, Payne 1997). Both Brush *Cacomantis variolosus* and Chestnut-breasted Cuckoos *C. castaneiventris* were regularly recorded near the nest, and the egg of the former species is apparently rather similar to that observed here (Payne 1997). The nest appeared abandoned due to disturbance and tampering, or due to being parasitised (CTS pers. obs.).

TORRENT-LARK *Grallina bruijini* * (Wat)
CMBRS (875 m): on 14 October an adult was flushed from an empty nest on an exposed branch dangling *c.*2 m above a fast-flowing stream. The nest was a compacted construction of mud and plant material, including epiphyte roots, atop a flexible branch thinner than the nest (OD 12 cm) (CTS pers. obs.).

HOODED BUTCHERBIRD *Cracticus cassicus* (Ins)
Haia (770 m): on 22 September an adult was observed transporting a large twig to a nest *c.*18 m high in a large *Terminalia* sp., within an old garden. The nest, a sparse layer of twigs and small branches, was possibly still being constructed. A maximum of five birds was observed in the immediate vicinity during mid morning, calling and displaying in a 50-m radius (CTS pers. obs.).

GREY CROW *Corvus tristis* * (Fru)
Yabaramaru (510 m): on 24 July a landowner showed CTS an old nest site, reputedly used by this species in the past (LO pers. comm.). The large nest of OD *c.*50–60 cm was at least 25 m high in the fork of a canopy tree (*Motu*, height *c.*32 m, dbh 3.24 m) (CTS pers. obs.).

Haia (770 m): a nest tree, *c.*2 km north-west of Haia, indicated to have been used by this species was shown to CTS by a local landowner. The nest, a platform of large twigs, was *c.*35 m above ground, near the top of a large canopy emergent. A Sulphur-crested Cockatoo was observed using a cavity in the same tree (see Rainbow Lorikeet account).

Haia (June, 790 m): on 27 August two juveniles were observed soliciting from adults *c.*1 km north of Haia in forest at the edge of a recently abandoned garden.

Discussion and concluding remarks

Salvadori's Teal nests observed on the Wi River during this study were probably further downstream than those recorded by Diamond (1972). Those noted by

Diamond (1972) in July were described as grass-lined depressions on a riverside rock, but they were probably inactive. These are low-altitude records for a species that prefers clear, fast-flowing alpine streams (Diamond 1972, Coates 1985). Habitat quality, rather than altitude, is thus more likely an important factor in determining the range and breeding distribution of Salvadori's Teal (Diamond 1972). On Mount Wilhelm (above 3,215 m), on the lower Pindauande Lake, two nests in which eggs had already hatched were found in consecutive years (Smith 1976). Egg remains in these nests, both on a mossy ledge *c.*1 m above water level, suggested that no more than 2–3 eggs were laid in each (Smith 1976). Further, the observation of only a single pair on the lake suggested that both nests belonged to the same pair (Smith 1976). It is therefore unknown whether the four nest scrapes found on the Wi in this study were made by a single (the same?) pair in successive years or more than one pair in the same year. Based on Smith (1976) and the infrequent sightings of large flocks on rivers in the region, we suggest that the same pair returned annually to a traditional or safe nest site. In two consecutive years (1971/72) ducklings with adults were observed in August and July (Smith 1976), indicating earlier egg laying than in our study.

Observations made on 24 March–10 November 1977 regularly recorded small numbers of Salvadori's Teal on the Baiyer River, where the species was often seen feeding at a point where the river rushes over rocky outcrops (Bishop 1977). On 14 October 1977 two young were brought to the Baiyer River Wildlife Sanctuary but subsequently died (Bishop 1977). In October of another year, four ducklings were brought in and marked with broad black and white stripes (Bishop 1977). These dates accord with breeding times recorded in our study, months most likely to be considered the dry season outside the study area.

It is difficult, given the few data, to determine breeding seasons of respective guilds in relation to any minor variation in rainfall. We therefore suggest that a combination of factors (e.g. day-length, seasonal food availability and natural breeding cycles) trigger breeding in the region. However, at CMBRS, over a 3.5-year period, no seasonal variation in overall fruiting patterns was detected (Wright *et al.* 1997). If any pattern of rainfall is detectable at Haia (Igag 2002) then most frugivore breeding records were in the dry season and insectivore and mixed feeders in the early-wet. Very few species recorded in our study can be considered strict nectarivores, thus if nectarivore records are grouped with mixed feeders the number of records for this guild in the early-wet season increases (Table 2). All waterbird records were in the early-wet season, according with Bishop (1977), Diamond (1972) and Coates (1985).

In lowland forest, Bell (1982) noted avian breeding seasons to be in the late-dry season (September–October, austral spring), although breeding occurred year-round. Mixed feeders, including honeyeaters, had patterns similar to carnivores, breeding during the dry season, peaking in December (Bell 1982). Our study may possess insufficient data to make interpretations on an annual scale, but there is evidence to suggest a distinct difference in breeding times between guilds.

Few waterbirds occur in Crater Mountain yet all three known residents were recorded breeding (Mack 1994). It is probable that they always breed close to fast-flowing rivers and that nest failures as a result of rapid fluctuations in water levels due to heavy rains may occur. During our study all waterbird records were in the early-wet season, according with Bishop (1977), Diamond (1972) and Coates (1985).

In CMWMA Eclectus Parrots showed no seasonality in breeding patterns, although Vulturine Parrots and Palm Cockatoos did, breeding in the wet season (July–November) (Igag 2002). The more specialised diets of the latter two may be instrumental in determining breeding patterns.

Thirty-six species were incidentally recorded breeding at CMBRS during *c.*30 months (May 1990–March 1993) research on Dwarf Cassowary *Casuarius bennetti* (Mack 1994). The CMWMA encourages research as an alternative income to logging for local communities. However, researchers tend to conduct short-term studies in the area and incidental information collected is 'lost' in offices and files at various research institutions. By publishing these data, questions concerning the breeding biology of birds in tropical regions can begin to be addressed.

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On the type series of *Macropsalis kalinowskii* (Berlepsch & Stolzmann 1894) (Caprimulgidae)

by Nigel Cleere

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Swallow-tailed Nightjar *Uropsalis segmentata* is a little-known Andean species that inhabits montane forests from central Colombia south to central Bolivia (Cleere 1998, 1999, Holyoak 2001). Two races are currently recognised, *U. s. segmentata* (Cassin 1849) in Colombia and Ecuador and *U. s. kalinowskii* (Berlepsch & Stolzmann 1894) in central Peru to central Bolivia. They differ in the size and markings of the outer tail feathers in adult males.

The nominate race was described under the name *Hydropsalis segmentatus* by Cassin (1849) from two Bogotá specimens originally in the Rivoli collection. The specimens were identified as a middle-age male and young female, and are now deposited in the Academy of Natural Sciences in Philadelphia (ANSP), where they were documented as ANSP 21.939 male, type, and ANSP 21.941 by Stone (1899). The nomination of ANSP 21.939 as the type was an act of lectotypification by Stone and ANSP 21.941 therefore became a paralectotype.

Macropsalis kalinowskii was described by Berlepsch & Stolzmann (1894) from eight specimens, five males and three females, collected by J. Kalinowski at Pariayacu, near Maraynioc, in central Peru on 26 October 1891, 5 and 6 November 1891, 12 December 1891, 16 September 1892 and 26 February 1893. The types were stated to be in the Branicki [*sic*] collection and the Berlepsch collection,